Citation:

McNamara DJ. The impact of egg limitations on coronary heart disease risk: Do the numbers add up? *J Am Coll Nutr*. 2000 Oct; 19 (5 Suppl): 540S-548S.

PubMed ID: 11023005

Study Design:

Meta-analysis or Systematic Review

Class:

M - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

- This review reports an analysis of the data from cholesterol feeding trials in humans to evaluate the effects of dietary cholesterol on plasma total cholesterol levels as well as plasma lipoprotein cholesterol levels and the factors which could affect dietary cholesterol-induced changes in plasma cholesterol levels and heart risk
- The evidence for heterogeneity in the plasma cholesterol response to dietary cholesterol is also evaluated, including estimates of the relative plasma cholesterol changes in hyper-responders and hypo-responders
- Finally, the effects of dietary cholesterol and egg, restrictions on plasma cholesterol levels and coronary heart disease (CHD) risk in the population are evaluated.

Inclusion Criteria:

Published cholesterol feeding studies since 1960 that used a cross-over design with cholesterol intake being the sole experimental variable.

Exclusion Criteria:

None reported.

Description of Study Protocol:

Recruitment

Not described.

Design

Meta-analysis of cholesterol feeding trials that used a cross-over design.

Dietary Intake/Dietary Assessment

Not applicable.

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

Not described.

Data Collection Summary:

Timing of Measurements

Studies published since 1960 were included in the analysis.

Dependent Variables

- Total cholesterol level
- LDL-cholesterol level
- HDL-cholesterol level.

Independent Variables

Cholesterol or egg intake.

Control Variables

Not applicable.

Description of Actual Data Sample:

- *Initial N:* Not reported
- *Attrition (final N):* N=167 published cholesterol feeding trials in 3,519 subjects dating back to 1960
- *Age:* Not applicable
- *Ethnicity:* Not applicable
- *Other relevant demographics:* Not applicable
- *Anthropometrics:* Not applicable
- *Location:* Not applicable.

Summary of Results:

Effects on Plasma Cholesterol Levels

- Plasma cholesterol levels increase as dietary cholesterol increases, but becomes attenuated at very high cholesterol intake levels

- Looking at studies that examined cholesterol challenges <1,200mg per day, there is a linear relationship between change in cholesterol intake and change in plasma cholesterol with a slope of 0.022mg/ dL per mg per day cholesterol (±0.13, 95% CI 1.9-2.5)
- Dietary fat calories and type of dietary fat consumed had no significant effects on the plasma cholesterol response to dietary cholesterol. Also, the plasma cholesterol response does not differ between hyper- and hypo-cholesterolemic individuals.

Effects on Plasma Lipoprotein Levels

- Using the studies that reported the effects of dietary cholesterol in plasma lipoprotein cholesterol levels (N=69) the estimated responses to a 100mg per day change in dietary cholesterol are:
  - 2.36mg/dL for total cholesterol (95% CI 2.00-2.73)
  - 2.07mg/dL for LDL (95% CI 1.71-2.42)
  - 0.44mg/dL for HDL (95% CI 0.34-0.55).

Hypo-Responders and Hyper-Responders

- The dose adjusted response to a 100mg per day dietary cholesterol challenge in hyper-responders is 3.9±0.6mg/dL (N=10, 95% CI 2.5-5.3) compared to a response in hypo-responders of 1.4±0.2mg/dL (N=13, 95% CI 1.0-1.9) (P=0.0002)
- The LDL response to a 100mg per day dietary cholesterol challenge in hyper-responders is 2.84±0.66mg/dL (N=5) compared to a response in hypo-responders of 0.76±0.25mg/dL (N=5) (P=0.0185)
- The HDL response to a 100mg per day dietary cholesterol challenge in hyper-responders is 0.69±01.6mg/dL (N=5) compared to a response in hypo-responders of 0.50±0.14mg/dL (N=5) (P<0.05).

Eggs and Plasma Cholesterol

- The decrease in per capita egg consumption from 321 eggs per year in 1960 to 235 eggs per year in 1995 equates to an average decrease of 1.65 eggs per week which, at a cholesterol content of 215mg per large egg, lowers the average dietary cholesterol intake by 355mg per week or 51mg per day
- A 51mg per day decrease in dietary cholesterol would be predicted to lower the mean plasma total cholesterol by 1.1mg/dL, due to a 0.9mg/dL decrease in LDL and a 0.2mg/dL decrease in HDL
- Based on these data, the 27% decrease in per capita egg consumption from 1960 to 1995 accounts for only 3% of the 30mg/dL fall in the average cholesterol levels in the population during this time period.

Eggs and LDL:HDL Cholesterol Ratio

An addition of an egg a day to the diet increases plasma LDL by 4.1mg/dL and HDL by 0.9mg/dL with changes in the LDL:HDL ratio ranging from 0.3 in the low LDL model to 0.01 in the high LDL model.

Author Conclusion:

- Dietary cholesterol has a small, but measurable effect on plasma cholesterol levels
- The plasma cholesterol response to dietary cholesterol is independent of dietary fat type and amount and independent of the baseline plasma cholesterol level and dietary cholesterol

increment
- Both hypo- and hyper-responders increase plasma total cholesterol in response to dietary cholesterol by increasing both LDL- and HDL-cholesterol concentrations, but the LDL cholesterol increase is significantly higher in the hyper-responders.
- Egg consumption has little relationship to hypercholesterolemia or CHD incidence.

Reviewer Comments:

None.

Research Design and Implementation Criteria Checklist: Review Articles

Relevance Questions		
1.	Will the answer if true, have a direct bearing on the health of patients?	Yes
2.	Is the outcome or topic something that patients/clients/population groups would care about?	Yes
3.	Is the problem addressed in the review one that is relevant to nutrition or dietetics practice?	Yes
4.	Will the information, if true, require a change in practice?	Yes

Validity Questions		
1.	Was the question for the review clearly focused and appropriate?	Yes
2.	Was the search strategy used to locate relevant studies comprehensive? Were the databases searched and the search termsused described?	Yes
3.	Were explicit methods used to select studies to include in the review? Were inclusion/exclusion criteria specified and appropriate? Were selection methods unbiased?	Yes
4.	Was there an appraisal of the quality and validity of studies included in the review? Were appraisal methods specified, appropriate, and reproducible?	Yes
5.	Were specific treatments/interventions/exposures described? Were treatments similar enough to be combined?	Yes
6.	Was the outcome of interest clearly indicated? Were other potential harms and benefits considered?	Yes
7.	Were processes for data abstraction, synthesis, and analysis described? Were they applied consistently across studies and groups? Was there appropriate use of qualitative and/or quantitative synthesis? Was variation in findings among studies analyzed? Were heterogeneity issued considered? If data from studies were aggregated for meta-analysis, was the procedure described?	Yes
8.	Are the results clearly presented in narrative and/or quantitative terms? If summary statistics are used, are levels of significance and/or confidence intervals included?	Yes

9.	Are conclusions supported by results with biases and limitations taken into consideration? Are limitations of the review identified and discussed?	Yes
10.	Was bias due to the review's funding or sponsorship unlikely?	Yes